WHAT IS CLAIMED IS:

1. An optical communications system comprising:

a transmitter subsystem comprising:

at least two optical transmitters, each for generating an optical signal containing a subband of information, each optical signal having a different polarization; and

an optical combiner coupled to the optical transmitters for optically combining the optical signals into a composite optical signal.

2. The optical communications system of claim 1 wherein the optical signals are orthogonally polarized.

3. The optical communications system of claim 2 wherein:

each optical transmitter comprises:

an optical source for producing an optical carrier; and

an electro-optic modulator coupled to the optical source for modulating the optical carrier with the subband of information; and

at least one of the optical transmitters further comprises:

a polarization controller for making a polarization of the optical signal orthogonal to a polarization of the other optical signal.

4. The optical communications system of claim 2 wherein:

at least one of the optical transmitter comprises:

a wavelength-tunable optical source, whereby a wavelength of the optical signal can be tuned by tuning the wavelength-tunable optical source; and

the transmitter subsystem further comprises:

a comb filter having periodically spaced pass bands coupled to the optical combiner.

5. The optical communications system of claim 1 wherein:

each optical signal has a lower optical sideband and an upper optical sideband; and

each optical transmitter comprises:

an optical filter for selecting one optical sideband from the optical signal.

6. The optical communications system of claim 1 wherein:

each optical signal has a lower optical sideband and an upper optical sideband; and

the transmitter subsystem further comprises:

an optical filter coupled to the optical combiner for selecting one optical sideband from each optical signal.

7. The optical communications system of claim 6 wherein the optical filter comprises:

two Bragg filters coupled in series.

8. The optical communications system of claim 6 wherein the optical filter comprises:

a comb filter having periodically spaced pass bands.

9. The optical communications system of claim 6 wherein the optical filter selects a lower optical sideband from one optical signal and an upper optical sideband from a different optical signal.

10. The optical communications system of claim 6 wherein the optical filter attenuates out-of-band wavelengths.

11. The optical communications system of claim 1 wherein the transmitter subsystem further comprises:

a wavelength-locking device coupled to the optical transmitters for locking a frequency separation of the optical signals to a predetermined value.

12. The optical communications system of claim 11 wherein:

each optical signal has a lower optical sideband and an upper optical sideband; and the transmitter subsystem further comprises:

an optical filter coupled to the optical combiner for selecting a lower optical sideband from a first optical signal and an upper optical sideband from a second optical signal;

a first optical tap coupled between the optical combiner and the optical filter for tapping a portion of the combined optical signals leaving the optical combiner;

a second optical tap coupled to the optical filter for tapping a portion of a composite optical signals leaving the optical filter; and

the wavelength-locking device is coupled to the first optical tap and to the second optical tap, for locking the frequency separation based on a ratio of the portions tapped by the optical taps.

13. The optical communications system of claim 12 wherein the wavelength-locking device comprises:

a first sinusoidal generator coupled to a first optical transmitter for injecting a modulation at a frequency f1 onto the optical signal produced by the first optical transmitter;

a second sinusoidal generator coupled to a second optical transmitter for injecting a modulation at a frequency f2 onto the optical signal produced by the second optical transmitter;

a first photodetector coupled to the first optical tap;

a first synchronous detector coupled to the first photodetector and to the sinusoidal generators, for detecting frequency components which are integer multiples of the frequencies f1 and f2;

a second photodetector coupled to the second optical tap;

a second synchronous detector coupled to the second photodetector and to the sinusoidal generators, for detecting frequency components at the same frequencies as the

frequency components detected by the first synchronous detector; and

comparison circuitry coupled to the synchronous detectors for comparing a strength of the frequency component at the integer multiple of the frequency f1 detected by the first synchronous detector to that detected by the second synchronous detector, for comparing a strength of the frequency component at the integer multiple of the frequency f2 detected by the first synchronous detector to that detected by the second synchronous detector, and for generating errors signals for the optical transmitters based thereon.

14. The optical communications system of claim 1 wherein each optical transmitter includes:

at least two electrical transmitters for generating electrical channels;

an FDM multiplexer coupled to the electrical transmitters for FDM multiplexing the electrical channels into an electrical high-speed channel, the electrical high-speed channel further including a tone; and

an E/O converter coupled to the FDM multiplexer for converting the electrical high-speed channel into the optical signal.

15. The optical communications system of claim 14 wherein the at least two optical transmitters comprise:

a first optical transmitter for generating a first optical signal containing at least two subbands and a tone, at least one of the subbands including asynchronous I and Q signals.

16. The optical communications system of claim 15 wherein:

each of the asynchronous I and Q signals is based on a separate OC-48 signal; and

the subband including the asynchronous I and Q signals has a capacity of approximately 5.0 Gbps of information.

17. The optical communications system of claim 14 wherein the at least two optical transmitters comprise:

a first optical transmitter for generating a first optical signal containing at least two subbands and a tone, each subband having a capacity of approximately 2.5Gbps of information; and

a second optical transmitter for generating a second optical signal containing at least two subbands and a tone, each subband having a capacity of approximately 2.5Gbps of information, wherein the second optical signal is orthogonally polarized to the first optical signal.

18. The optical communications system of claim 17 wherein:

the first optical signal has a lower optical sideband and an upper optical sideband, each optical sideband containing the at least two subbands and tone;

the second optical signal has a lower optical sideband and an upper optical sideband, each optical sideband containing the at least two subbands and tone; and

the transmitter subsystem further comprises:

an optical filter coupled to the optical combiner for passing the lower optical sideband of the first optical signal and the upper optical sideband of the second optical signal.

19. The optical communications system of claim 1 further comprising:

a receiver subsystem coupled to the transmitter subsystem by an optical fiber for recovering the subbands from the composite optical signal.

20. The optical communications system of claim 19 wherein the receiver subsystem comprises:

a polarizing splitter module for splitting the composite optical signal according to polarization; and

a plurality of heterodyne receivers coupled to the polarizing splitter module for recovering the subbands.

21. The optical communications system of claim 19 wherein the receiver subsystem comprises:

an optical splitter module for splitting the composite optical signal; and

a plurality of heterodyne receivers coupled to the optical splitter module for recovering the subbands, wherein at least one heterodyne receiver comprises:

a polarization controller for matching a polarization of an optical local oscillator signal for the heterodyne receiver and a polarization of a tone in a portion of the composite optical signal received by the heterodyne receiver.

22. An optical communications system comprising:

a transmitter subsystem comprising:

a first optical transmitter for generating a first optical signal containing a lower optical sideband and an upper optical sideband;

a second optical transmitter for generating a second optical signal containing a lower optical sideband and an upper optical sideband;

an optical combiner coupled to the optical transmitters for optically combining the first optical signal and the second optical signal; and

an optical filter coupled to the optical combiner for selecting the upper optical sideband of the first optical signal and the lower optical sideband of the second optical signal to produce a composite optical signal.

23. The optical communications system of claim 22 wherein:

at least one of the optical transmitter comprises:

a wavelength-tunable optical source, whereby a wavelength of the optical signal generated by the optical transmitter can be tuned by tuning the wavelength-tunable optical source; and

the optical filter comprises:

a comb filter having periodically spaced pass bands.

24. The optical communications system of claim 22 wherein the optical filter comprises:

two Bragg filters coupled in series.

25. The optical communications system of claim 22 wherein the optical filter comprises:

a comb filter having periodically spaced pass bands.

26. The optical communications system of claim 22 wherein the optical filter attenuates out-of-band wavelengths.

27. The optical communications system of claim 22 wherein the transmitter subsystem further comprises:

a wavelength-locking device coupled to the optical transmitters for locking a frequency separation of the optical signals to a predetermined value.

28. The optical communications system of claim 22 wherein each optical transmitter includes:

at least two electrical transmitters for generating electrical channels;

an FDM multiplexer coupled to the electrical transmitters for FDM multiplexing the electrical channels into an electrical high-speed channel, the electrical high-speed channel further including a tone; and

an E/O converter coupled to the FDM multiplexer for converting the electrical high-speed channel into the optical signal.

29. The optical communications system of claim 22 further comprising:

a receiver subsystem coupled to the transmitter subsystem by an optical fiber, the receiver subsystem comprising:

an optical splitter for splitting the composite optical signals into multiple signals;

and

a plurality of heterodyne receivers coupled to the optical splitter for recovering information from the signals.

30. An optical communications system comprising:

a transmitter subsystem comprising:

an optical transmitter for generating an optical signal containing at least two subbands of information; and

a polarization controlling device coupled to the optical transmitter for varying a polarization of the subbands so that the subbands have different polarizations.

31. The optical communications system of claim 30 wherein the polarization controlling device comprises a birefringent medium.

32. The optical communications system of claim 30 wherein:

the optical transmitter comprises:

a wavelength-tunable optical source, whereby a wavelength of the optical signal can be tuned by tuning the wavelength-tunable optical source; and

the transmitter subsystem further comprises:

a comb filter having periodically spaced pass bands.

33. The optical communications system of claim 30 wherein:

the optical signal has a lower optical sideband and an upper optical sideband; and

the transmitter subsystem further comprises:

an optical filter coupled to the polarization controlling device for selecting one optical sideband.

34. The optical communications system of claim 33 wherein the optical filter comprises:

a comb filter having periodically spaced pass bands.

35. The optical communications system of claim 33 wherein the optical filter attenuates out-of-band wavelengths.

36. The optical communications system of claim 30 wherein the optical transmitter includes:
at least two electrical transmitters for generating electrical channels;
an FDM multiplexer coupled to the electrical transmitters for FDM multiplexing the electrical channels into an electrical high-speed channel, the electrical high-speed channel further including a tone; and
an E/O converter coupled to the FDM multiplexer for converting the electrical high-speed channel into the optical signal.

37. The optical communications system of claim 30 further comprising:
a receiver subsystem coupled to the transmitter subsystem by an optical fiber for recovering the subbands from the optical signal.

38. A method for transmitting information across an optical fiber, the method comprising:
generating a first optical signal containing a first subband of information;
generating a second optical signal containing a second subband of information, the second optical signal having a different polarization than the first optical signal;
optically combining the optical signals into a composite optical signal; and
transmitting the composite optical signal across an optical fiber.

39. The method of claim 38 wherein the optical signals are orthogonally polarized.

40. The method of claim 38 wherein:
each optical signal has a lower optical sideband and an upper optical sideband, wherein an optical sideband of the first optical signal is adjacent to an optical sideband of the second optical signal; and
the method further includes the step of optically filtering the optical signals to attenuate

the non-adjacent optical sidebands.

41. The method of claim 40 wherein:

the step of optically combining the optical signals into a composite optical signal comprises:

optically combining the optical signals so that a lower optical sideband of the first optical signal is adjacent to an upper optical sideband of the second optical signal; and

the step of optically filtering the optical signals comprises:

optically filtering the optically combined optical signals to select the lower optical sideband of the first optical signal and the upper optical sideband of the second optical signal.

42. The method of claim 38 further comprising:

locking a frequency separation of the optical signals to a predetermined value.

43. The method of claim 38 wherein each of the steps of generating a first optical signal and generating a second optical signal comprises:

generating electrical channels;

FDM multiplexing the electrical channels into an electrical high-speed channel, the electrical high-speed channel further including a tone; and

converting the electrical high-speed channel into the optical signal.

44. The method of claim 43 wherein:

the step of generating a first optical signal comprises:

generating a first optical signal containing at least two subbands and a tone, at least one of the subbands including asynchronous I and Q signals.

45. The method of claim 44 wherein:

each of the asynchronous I and Q signals is based on a separate OC-48 signal; and

the subband including the asynchronous I and Q signals has a capacity of approximately 5.0 Gbps of information.

46. The method of claim 43 wherein:

the step of generating a first optical signal comprises:

generating a first optical signal containing at least two subbands and a tone, each subband having a capacity of approximately 2.5Gbps of information; and

the step of generating a second optical signal comprises:

generating a second optical signal containing at least two subbands and a tone, each subband having a capacity of approximately 2.5Gbps of information, wherein the second optical signal is orthogonally polarized to the first optical signal.

47. The method of claim 46 wherein:

the first optical signal has a lower optical sideband and an upper optical sideband, each optical sideband containing the at least two subbands and tone;

the second optical signal has a lower optical sideband and an upper optical sideband, each optical sideband containing the at least two subbands and tone; and

the step of optically combining the optical signals into a composite optical signal comprises:

optically combining the optical signals so that a lower optical sideband of the first optical signal is adjacent to an upper optical sideband of the second optical signal; and

filtering the optically combined optical signals to select the lower optical sideband of the first optical signal and the upper optical sideband of the second optical signal.

48. The method of claim 38 further comprising:

receiving the composite optical signal;

splitting the composite optical signal according to polarization; and

recovering the subbands using heterodyne detection.

49. The method of claim 48 wherein the step of recovering the subbands using heterodyne detection comprises:

matching a polarization of an optical local oscillator signal with a polarization of a tone in the split composite optical signal; and

mixing the pilot tone and the polarization-matched signal.

50. A method for transmitting information across an optical fiber, the method comprising:

generating a first optical signal containing a lower optical sideband and an upper optical sideband;

generating a second optical signal containing a lower optical sideband and an upper optical sideband;

optically combining the first optical signal and the second optical signal; and

optical filtering the optically combined signals to select the upper optical sideband of the first optical signal and the lower optical sideband of the second optical signal to produce a composite optical signal; and

transmitting the composite optical signal across an optical fiber.

51. The method of claim 50 wherein the first optical signal and the second optical signal are orthogonally polarized.

52. The method of claim 50 further comprising:

locking a frequency separation of the optical signals to a predetermined value.

53. The method of claim 50 wherein each of the steps of generating a first optical signal and generating a second optical signal comprises:

generating electrical channels;

FDM multiplexing the electrical channels into an electrical high-speed channel, the

electrical high-speed channel further including a tone; and

converting the electrical high-speed channel into the optical signal.

54. The method of claim 50 further comprising:

receiving the composite optical signal;

splitting the composite optical signal according to polarization; and

recovering the subbands using heterodyne detection.

55. An method for transmitting information across an optical fiber, the method comprising:

generating an optical signal containing at least two subbands of information;

varying a polarization of the subbands so that the subbands have different polarizations; and

transmitting the optical signal across an optical fiber.

56. The method of claim 55 wherein:

the optical signal has a lower optical sideband and an upper optical sideband; and

the method further includes the step of optically filtering the optical signal to select one optical sideband.

57. The method of claim 55 wherein the step of generating the optical signal comprises:

generating electrical channels;

FDM multiplexing the electrical channels into an electrical high-speed channel, the electrical high-speed channel further including a tone; and

converting the electrical high-speed channel into the optical signal.

58. The method of claim 55 further comprising:

receiving the optical signal; and

recovering the subbands using heterodyne detection.